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Response under 37 CFR §1.116
Application No. 10/501,813
Attorney Docket No. 042393

REMARKS**Rejections under 35 USC §103(a)**

Claims 1-2 and 6 were rejected under 35 USC §103(a) as being unpatentable over Castonguay (U.S. Patent No. 3,857,683) and Phillips (U.S. Patent No. 3,704,211)

First, it should be noted that the present invention is directed to “a method for forming a **high-Re-content alloy film which contains Re at 98 % or more** by atomic composition.” Nothing in Castonguay and Phillips teaches or suggest how such a high-Re-content alloy film is obtained.

Through extensive researches on a Re electroplating process, the inventors discovered that a Re alloy film having a Re content of 98% or more by atomic composition can be formed by adding into an electroplating bath an organic acid having at least one functional group selected from the group consisting of a hydroxyl group, a carbonyl group and an amino group, and controlling the respective compositions of the organic acid and a metal ion in the electroplating bath.

Admitting that Castonguay does not disclose “at least one of a Li ion and a Na ion, in a total concentration of 0.0001 to 5.0 mol/L” as recited in claim 1, the Examiner alleged as follows:

Castonguay teaches that additives where necessary to the performance of the bath are indicated, but additives such as are commonly used in electroplating may be useful to obtain results some systems (col. 3, lines 65-68).

Like Castonguay, Phillips teaches electroplating cobalt-rhenium (col. 3, line 51; and col. 4, Table 1). Phillips teaches that an electrolyte is used as

Response under 37 CFR §1.116
Application No. 10/501,813
Attorney Docket No. 042393

the electrical conductor. These include ammonium chloride, sodium sulphate decahydrate, sodium citrate, sodium potassium tartrate, and others. Some of these are aqueous solutions, and others are not. Some of the above materials are added as metal complexing or chelating agents (col. 3, lines 24-29).

Philips teaches 0-0.7 g/l P and 4.5-5.5 g/l Na (col. 4, Table I).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the solution described by Castonguay with wherein the solution includes at least one of a Li ion and a Na ion, in a total concentration of 0.0001 to 5.0 mol/L; . . . because these ions would have been commonly used in electrolytes as electrical conductors as taught by Phillips (col. 3, lines 24-29).

Castonguay discloses printed circuit board materials and describes cobalt-rhenium system as EXAMPLE XXIII. Castonguay further describes: "By varying the rhenium content in the bath from 3 to 80%, the rhenium content in the deposit may be varied from 25 to 95 %."

Castonguay also discloses nickel-rhenium system as EXAMPLE XLV. Castonguay further describes: "By varying the rhenium content in the bath from 6 to 98 %, the rhenium content in the deposit may be varied from 75 to 95 %."

In Castonguay, weight percentage is used. This indicates that Castonguay cannot obtain high-Re-content alloy containing Re at 98% or more. The upper limit of Re content 95 weight % is converted to atomic percentage as follows:

$$95 \text{ weight \%} = \frac{95/186.2}{(95/186.2) + (5/58.9)} \text{ atomic \%} = 85.8 \text{ atomic \%},$$

where 186.2 is the atomic weight of Re and 58.9 is the atomic weight of Co.

Response under 37 CFR §1.116
Application No. 10/501,813
Attorney Docket No. 042393

The value 95 weight % amount to 86 atomic % or less. Thus, Castonguay cannot obtain high-Re-content alloy containing Re at 98% or more. The same thing can be said about nickel-rhenium system because the atomic weight of Ni is 58.7, which is almost the same as that of Co.

Phillips discloses a process for depositing a nickel-cobalt magnetic electroplate. Regarding addition of rhenium, Phillips describes as follows:

It has been discovered that the addition of rhenium to a nickel-cobalt or a cobalt electroplating bath in a small but effective amount appears to serve as a grain refiner, usually up to approximately 1% of the final composition by weight and has the unexpected result of modifying and allowing control of the *Mr/Hc* ratio of the deposited film.

(Col. 3, lines 50-55). Thus, Re is added as a grain refiner and to modify or control *Mr/Hc* ratio. Even if Philips teaches use of Na ion in such a nickel-cobalt or a cobalt electroplating bath, it teaches nothing about high Re-content alloy.

In contrast, as explained in the specification, for example, at page 3, if the total concentration of a lithium ion and a sodium ion is less than 0.0001 mol/L, the Re content in a resulting plated film will be less than 98% by atomic composition. Also, the use of a concentration of the ion greater than 5.0 mol/L causes creation of an insoluble substance in the bath to result in deteriorated flowability of the aqueous solution.

Moreover, if the concentration of perrhenate ion is less than 0.1 mol/L, a resulting plated film cannot contain Re at 98% or more. Further, the use of a concentration of perrhenate ion greater than 8.0 mol/L causes creation of an insoluble substance in the bath. As to the at least one ion selected from the group consisting of nickel, iron, cobalt and chromium (III) ions, the use

Response under 37 CFR §1.116
Application No. 10/501,813
Attorney Docket No. 042393

of a total concentration of the ion less than 0.005 mol/L causes significant deterioration in plating efficiency. Further, if the total concentration of the ion is greater than 2.0 mol/L, the Re content in a resulting plated film will be less than 98% by atomic composition.

Even in case where these conditions are satisfied, if the concentration of the at least one organic acid selected from the group consisting of carboxylic acid, hydroxycarboxylic acid and amino acid, is equal to or less than 5.0 equivalents to the concentration of all of the metal ions, the Re content in a resulting plated film will be less than 98% by atomic composition. Further, the use of a concentration of the at least one organic acid greater than 15.0 equivalents causes creation of an insoluble substance in the bath to result in deteriorated flowability of the aqueous solution.

Thus, claim 1 specifies the interrelated conditions of the electroplating bath for forming a high-Re-content alloy film which contains Re at 98 % or more by atomic composition. The combination of Castonguay and Phillips do not teach or suggest the claimed invention. Also, it would not have been predictable that the claimed method can produce a high-Re-content alloy containing Re at 98 % or more.

For at least these reasons, claim 1 patentably distinguishes over Castonguay and Phillips. Claims 2 and 6, depending from claim 1, also patentably distinguish over Castonguay and Phillips for at least the same reasons.

Response under 37 CFR §1.116
Application No. 10/501,813
Attorney Docket No. 042393

In view of the aforementioned amendments and accompanying remarks, Applicants submit that the claims, as herein amended, are in condition for allowance. Applicants request such action at an early date.

If the Examiner believes that this application is not now in condition for allowance, the Examiner is requested to contact Applicants' undersigned attorney to arrange for an interview to expedite the disposition of this case.

If this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. The fees for such an extension or any other fees that may be due with respect to this paper may be charged to Deposit Account No. 50-2866.

Respectfully submitted,

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